Team Scientists: how do we enable everyone to get credit for their work?
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Biomedical research evolves: Accelerating discovery & implementation

• TEAM SCIENCE
• WORKFORCE DEVELOPMENT
• IDEATION & INNOVATION
• COMMUNICATION
• ASSESSMENT & IMPROVEMENT
• MATURATION OF THE ENVIRONMENT

https://ncats.nih.gov/translation/spectrum
Biomedical research evolves and opens

OPEN SCIENCE YIELDS:

- **SPEED**: The research process becomes faster
- **EFFICIENCY**: Data collection can be funded once, and used many times for a variety of purposes
- **ACCESSIBILITY**: Anyone can access and build upon research resources with minimal barriers to access
- **IMPACT & LONGEVITY**: Open publications and data are more discoverable and receive more citations long-term
- **TRANSPARENCY & QUALITY**: The evidence that underpins research can be made open for anyone to scrutinize and replicate findings, leading to a more robust scholarly record

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http://www.slideshare.net/martindonnelly/winning-horizon-2020-with-open-science
What is impact?

More than papers and grants – we are driving toward improved health and wellbeing

- Improvements in health through treatment and prevention
- Contributions to society through economic growth and productivity
- Expansion of the biomedical knowledge base through cutting-edge research
- Cultivation of the biomedical workforce of today and tomorrow

For effective translation of knowledge and discoveries into the improved health of our communities, it is essential to incorporate evaluation strategies that enable investigators and teams to measure, monitor, and communicate the impact of their work.

https://www.nih.gov/about-nih/what-we-do/impact-nih-research
Biomedical research evolves
Consider the entire research workforce and all that they do

Diverse outputs
Diverse impacts
Diverse roles
Each a critical component of the research process

- New experimental methods, data models, databases, or software tools
- New diagnostic criteria
- New standards of care
- Biological materials or animal models
- Consent documents
- Clinical/practice guidelines
- Quality measure guidelines
- Maps and visualizations
- Measurement instruments
- Continuing education materials
- Quality measure guidelines
- Cost-effective intervention
- Consensus development conferences
- Change in delivery of healthcare services
- Gray literature

https://becker.wustl.edu/impact-assessment
http://nucats.northwestern.edu/
Adapted from original by @figgyjam
Institutional perspectives & new models

Team Scientists

The Team Scientist track is for non-clinical faculty who make substantial contributions to the research and/or educational missions of the medical school. Faculty members whose primary activity is in research will typically engage in team science. Their skills, expertise and/or effort play a vital role in obtaining, sustaining and implementing programmatic research.

Faculty on this track often have expertise in epidemiology, clinical trials, biostatistics, biomedical informatics, outcomes research or other qualitative and quantitative research methodologies and generally contribute to clinical studies, patient-oriented clinical outcomes research, community-engaged research, population-based studies and/or basic science research. Typically, such faculty provide critical expertise to a program or group of research teams as a co-investigator with contributions that do not necessarily require or result in independent grant funding, but some faculty on this track may serve as principal investigator on related research. Faculty on this track do not perform clinical work but do contribute to the education and service missions of the medical school.

While most members of this track make research the major focus of their activity, for some members of this track education may be the major focus of their activity. Faculty focusing on education are typically recognized as outstanding educators and contribute to course development, degree program leadership and other innovative educational products.

For more information, view the Information Guide for Appointments, Promotion and Tenure (PDF).

Team Scientist Ranks
Team Scientist Track (variable amounts of effort distributed between research and education depending upon domain of activity)

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Faculty on this track do not perform clinical work but do contribute to the education and service missions of the medical school. While most members of this track make research the major focus of their activity, for some members of this track education may be the major focus of their activity. Faculty focusing on education are typically recognized as outstanding educators and contribute to course development, degree program leadership, and other innovative educational products. Faculty rank in this track will be titled Assistant Professor, Associate Professor, or Professor. This is a non-tenure-eligible regular faculty track.

Prepare your packet (clusters of work):
https://www.feinberg.northwestern.edu/fao/for-faculty/promo-tenure/prepare-your-packet.html
2015: a new “Team Scientist” track was established within our regular faculty lines to better value such scientists’ contributions.

Collaborative effort between NUCATS (Lloyd-Jones), Vice Dean for Faculty Affairs at Feinberg (Lowe), and relevant stakeholders.

Enthusiasm on campus by collaborative scientists, successful promotion pathway

Collaborative scientists who span content disciplines at NU now have several distinct pathways for promotion with clear metrics through our tenure-eligible, non-tenure-eligible, and research faculty lines.

### Team Scientist Faculty Track Survey Results

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<th>SATISFIED</th>
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<tbody>
<tr>
<td>Overall satisfaction with current position</td>
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<tr>
<td>Opportunity to collaborate with other faculty</td>
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<tr>
<td>Sense of contributing to important research</td>
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<tr>
<td>Contributions are acknowledged via co-authorships</td>
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<tr>
<td>Promotion process is clear and transparent</td>
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Fall, 2017 survey response rate: 81%
Herzog, Holmes, Lloyd-Jones
It takes technology + culture.
Game changer: Perhaps one of the biggest shifts in “culture” was the development, release, and implementation of the CRediT taxonomy, making it easier to give people credit for 14 specific contributions in a published work.

CRediT

CRediT is high-level taxonomy, including 14 roles, that can be used to represent the roles typically played by contributors to scientific scholarly output. The roles describe each contributor’s specific contribution to the scholarly output.

https://casrai.org/credit/
OpenVIVO

Implementation of a community-driven concept of credit, based on input from community workshops

1. Provide a VIVO experience for everyone, a demonstration of VIVO, a platform for experimentation, and an ownership experience for the VIVO team
2. Use persistent identifiers for all entities – people (ORCiD), works (DOI and PMID), organizations (GRID), journals (ISSN), concepts (FAST)
3. Automatic, real-time ingest of metadata from identifiers via public APIs
4. Publication of data
5. Consumption and reuse of data
6. Attribution of works by scholars to indicate roles in works

Around the same time we were hosting workshops to ask attendees – what do you want credit for?
OpenVIVO: Transparency in Scholarship

Violeta Ilik1, Michael Conlon2, Graham Triggs3, Marijane White4, Muhammad Javed5, Matthew Brush6, Karen Gutzman7, Shahim Essaid8, Paul Friedman9, Simon Porter10, Martin Szomszor10, Melissa Anne Haendel1, David Eichmann1 and Kristi L. Holmes6

1Stony Brook University, Stony Brook, NY, United States
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OpenVIVO is a free and open-hosted semantic web platform that anyone can join and that gathers and shares open data about scholarship in the world. OpenVIVO, based on the VIVO open-source platform, provides transparent access to data about the scholarly work of its participants. OpenVIVO demonstrates the use of persistent identifiers, the automatic real-time ingest of scholarly ecosystem metadata, the use of VIVO-ISF and related ontologies, the attribution of work, and the publication and reuse of data—all critical components of presenting, preserving, and tracking scholarship. The system was created by a cross-institutional team over the course of 3 months. The team created and used RDF models for research organizations in the world based on Digital Science GRID data, for academic journals based on data from CrossRef and the US National Library of Medicine, and created a new model for attribution of scholarly work. All models, data, and software are available in open repositories.

Transparency in Scholarship

Scholarship requires knowledge of previous work. The growth of scholarship worldwide and the proliferation of scholarly output types—from papers and monographs to preprints, conference papers, datasets, posters, and presentation slides—have fundamentally changed the scholarly ecosystem from an environment dependent on libraries to one that is dependent on the electronic resources made available by libraries to support discovery and knowledge transfer. This shift clearly drives a need for the representation of scholarly works using standard metadata formats to facilitate indexing and discovery.

For scholars to have knowledge of previous work, the work must be indexed and discoverable via electronic systems. Metadata regarding the scholarly work must be captured and preserved. This article highlights how OpenVIVO can be used as a tool to enhance the transparency of scholarly work.
1. Provide a VIVO experience for everyone, a demonstration of VIVO, a platform for experimentation, and an ownership experience for the VIVO team.

2. Use persistent identifiers for all entities—people (ORCiD), works (DOI and PMID), organizations (GRID), journals (ISSN), concepts (FAST).

3. Automatic, real-time ingest of metadata from identifiers via public APIs.

4. Publication of data.

5. Consumption and reuse of data.

6. Attribution of works by scholars to indicate roles in works.

Next stop: map community workshop input on top of a sturdy foundation of CRedIT.
Game changer: Perhaps one of the biggest shifts in “culture” was the development, release, and implementation of the CRediT taxonomy, making it easier to give people credit for their specific contribution in a published work.

CRediT

CRediT is high-level taxonomy, including 14 roles, that can be used to represent the roles typically played by contributors to scientific scholarly output. The roles describe each contributor’s specific contribution to the scholarly output.

CRediT ontology in OWL:
https://github.com/data2health/credit-ontology

https://casrai.org/credit/
**Contribution Role Ontology**

The Contribution Role Ontology (CRO) contains classes representing scholarly contributions. The CRO imports classes from the CRediT ontology\(^1\) (computational version of the CRediT taxonomy\(^2\)), in **bold**.

**NISO Research Outputs**

Classes from the CRO have relationships to scholarly outputs, which are represented as NISO research outputs\(^3\). The top level terms are the NISO high level classifications and the lower level terms are some examples subtypes, with corresponding ontology mappings (more expansive list of subtypes available).

**References**

1. [https://github.com/data2health/credit-ontology](https://github.com/data2health/credit-ontology)
2. [https://casrai.org/credit/](https://casrai.org/credit/)

Join us! Submit tickets! 😊
https://github.com/data2health/contributor-role-ontology or https://github.com/data2health/architecting_attribution
Research Objects: A Common Unit of Sharing Across Use Cases

- Computable Workflows Comprised of Reusable Content
  - Reproducible and rigorous methodologies
- Repositories of Reusable Content (Data, Information, Knowledge)
  - Data Sets, Software, Formalized Knowledge, Publications
- "Signals" of Research Activity and Knowledge Sharing
  - Publication, Contribution, Attribution, Dissemination

Extensible, standards-based “primitive” that defines a minimal shareable product (MSP)
Architecting Attribution

Products to be delivered:
• Contribution Role Ontology
• Digital research object taxonomy
• Annotation file format
• Attribution workflow for research information systems and other use cases
• Local guide to support attribution in CTS at the person-level
• Demonstrator for the individual

Milestones with Dates
April: enhanced contribution role ontology
May: finalize strategy for digital object types
May: finalize annotation file format
August: demonstrator for the individual
Fall: Credit, Attribution, and Incentives workshop

What will be delivered by fall:
• CRedIT Ontology, Contribution Role Ontology, digital research object taxonomy, translational research object taxonomy, & annotation file format
• Local guide to support attribution in CTS at the hub level
• Demonstrator for the individual to generate content for CVs, biosketches, etc.

https://github.com/data2health/architecting_attribution
(sign-up at the bottom of the page)
Thank you!

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